Development of the Immune System in The First 1000 Days

FIRST 1,000 DAYS ARE CRUCIAL FOR LIFELONG HEALTH

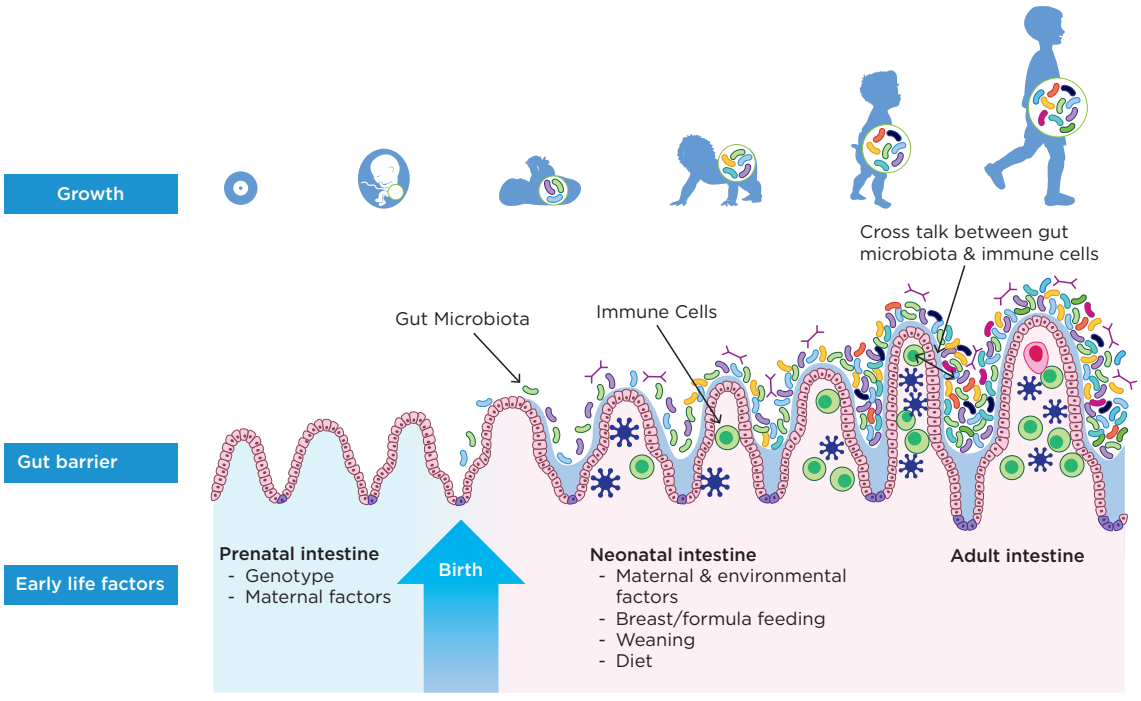
The first 1,000 days – from conception up to two years of age – are key for the development of a healthy gut and immune system, laying the foundation for lifelong health.[1,2] Research highlights the important interplay between the gut, the gut microbiota and early life nutrition in supporting the development of a healthy immune system during this crucial period.[3] The gut undergoes rapid growth and differentiation, and it takes a while for infants' digestive system to start functioning at full capacity (see Figure 1).[4]

A HEALTHY **GUT MICROBIOTA** IS ESSENTIAL FOR THE DEVELOPMENT OF A **RESILIENT IMMUNE SYSTEM**

IMMUNE SYSTEM DEVELOPMENT AFTER BIRTH

The immune system continues to develop after birth.[4,5] This development is fundamental as infants move from a protected environment in the womb to one where the immune system has to act and adapt to a huge number of antigens and microbes.[4] This 'homeostatic capacity' of the immune system has recently been described as 'resilience'.[6]

THE GUT HOSTS **70-80%** OF THE HUMAN BODY'S **IMMUNE CELLS**



Adapted from Wopereis H et al. (2014) Pediatr Allergy Immuno 25:428-38

Figure 1. Gut microbiota and immune system development in early life[4]

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THE GUT IS THE CENTRE OF THE IMMUNE SYSTEM

The key place of immune system development is the gut, which is our largest immune organ.[7] In adults, it has a surface area of approximately 30m² [8] and hosts 70-80% of the human body's immune cells.[9] The gut barrier is part of the first line of defence against pathogens and mediates immune responses via a dynamic system consisting of a large number of different immune cells.[7]

In addition, the gut contains around 100 trillion bacteria[10] which is essential for the development of a resilient immune system.[11] For example, gut bacteria provide several immune signals, affecting the maturation of the gut-associated lymphoid tissue (GALT), the mucosal barrier and mucus secretion, production of antimicrobial peptides (defensins) and stimulation of mucosal immune cells (sIgA).[12]

EARLY LIFE NUTRITION HELPS TO TRAIN THE IMMUNE SYSTEM

Early life nutrition greatly enables a healthy immune system and gut microbiota development.[3] Specific nutritional components can selectively stimulate growth and activity of the gut microbiota, thereby impacting the gut microbiota colonisation and maturation of the gut and the immune system.[13] This is known to be a dynamic process during the first 1,000 days, influencing lifelong health.[3]

BREAST MILK IS BEST FOR INFANTS

The best nutrition in early life is breast milk, supporting development of the gut microbiota and immune system.[14-17] These beneficial effects are due to many bioactive compounds, oligosaccharides and low levels of bacteria (e.g. Streptococci, Lactobacilli and Bifidobacteria) and their metabolites naturally present in breast milk seem to play a key role in the immune system through the gut.[18]

TO REMEMBER:

- The first 1,000 days – from conception up to two years of age – lay the foundation for lifelong health.
- During this period, the gut, the gut microbiota and the immune system need to develop to protect the child from environmental challenges.
- Early life nutrition is a key factor influencing the immune system through the gut.

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